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1. A 10 year old boy with Duchennes muscular dystrophy(DMD) presents for spine surgery from T3 to the pelvis. His past medical history is significant for respiratory failure requiring BiPAP. Which of the following statements is false.

- A. Forced vital capacity would be important to assess risk and survival.
- B. They are prone to malignant hyperthermia
- C. Succinlycholine can cause hyperkalemic arrest in these patients
- D. Intraoperative neuromonitoring(IONM) is frequently performed

Go to Q 2



A. Forced vital capacity would be important to assess risk and survival.

The majority of patients with Duchenne's muscular dystrophy require corrective spinal surgery for scoliosis to maintain seated balance and to slow their rate of respiratory compromise. Measurement of preoperative forced vital capacity is important to determine to assess risk for postoperative respiratory complications and failure to wean. Previous studies have shown poor outcome with $FVC < 30\%$. Recent studies have shown that patients with lower FVCs could still have a successful outcome with the use of non-invasive ventilation after tracheal extubation in these patients.

Ref; Anaesthesia, 2004, 59, pages 1160–1162 The prognostic value of pre-operative predicted forced vital capacity in corrective spinal surgery for Duchenne's muscular dystrophy C. M. Harper et al.,

Incorrect

[Try again](#)



B.They are prone to malignant hyperthermia

A literature search was undertaken by Gurnaney and colleagues and they did not find an increased risk of malignant hyperthermia susceptibility in patients with DMD or BD (Beckers dystrophy) compared with the general population. However, dystrophic patients who are exposed to inhaled anesthetics may develop a malignant hyperthermia-like syndrome characterized by rhabdomyolysis. The lack of evidence to support an association between DMD or BMD and MH has led to the proposal of an alternative mechanism termed 'anesthesia-induced rhabdomyolysis' (AIR). Dantrolene may be of no use for AIR as the proposed mechanism involves the breakdown of muscle cell membranes and subsequent leakage of cell contents.

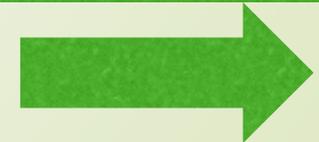
Anesth Analg. 2009 Oct;109(4):1043-8. Malignant hyperthermia and muscular dystrophies. Gurnaney H^{et al.}

Pediatric Anesthesia 2008 18: 100–106. Duchenne muscular dystrophy: an old anesthesia problem revisited. Jason Hayes et al.

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C. Succinylcholine can cause hyperkalemic arrest in these patients

DMD patients are prone to develop serious problems during surgery and anesthesia. Anesthetic complications in patients with DMD include intraoperative heart failure, inhaled anesthetic-related rhabdomyolysis (absence of succinylcholine), and succinylcholine-induced rhabdomyolysis and hyperkalemia.

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D. Intraoperative neuromonitoring(IONM) is frequently performed

The use of intraoperative neuromonitoring (IONM) during pediatric scoliosis repair has become commonplace to reduce the risk of potentially devastating postoperative neurologic deficits. Techniques include somatosensory evoked potentials, motor evoked potentials, electromyography, and intraoperative wake-up tests

Anesthesiol Clin. 2014 Mar;32(1):101-14.
Neuromonitoring for scoliosis surgery.
Glover CD^{et al.}

Incorrect

[Try again](#)



2. A 10 year old boy undergoes scoliosis surgery. Surgeons are using neuromonitoring; both sensory and motor evoked potentials. During the procedure the neuromonitoring tech reports to you that signals in the lower extremity are lost. All of the following are appropriate actions at this time except

- A. Inform surgeon
- B. Decrease mean arterial pressure
- C. Warm the patient
- D. Send a blood gas to check hematocrit

Go to Q 3



A. Inform surgeon

Surgeon should be notified so that any surgical spinal distraction could be rectified.

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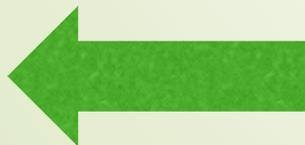
Correct answer



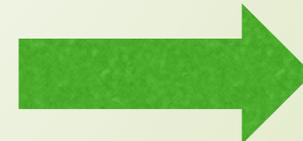
B. Decrease mean arterial pressure

With decreases in mean arterial blood pressure as a result of either blood loss or vasoactive drugs, progressive changes in SSEP are observed characterized by decreases in amplitude until loss of the waveform with no changes in latency. These changes resolve with increases of arterial blood pressure to slightly higher than the patient's normal pressure; this finding suggests that the combination of surgical manipulation with levels of hypotension generally considered "safe" could result in spinal cord ischemia

Back to the Question



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C. Warm the patient

Hypothermia causes increases in latency and decreases in amplitude of cortical and subcortical SERs after all types of stimulation. Hence warming the patient judiciously without instituting hyperthermia would be optimal.

Incorrect

[Try again](#)

D. Send a blood gas to check hematocrit

Changes in arterial blood gas tensions can alter SERs (sensory evoked response), probably in relation to changes in blood flow or oxygen delivery to neural structures. Hypoxia produces SSEP changes (decreased amplitude) similar to the changes seen with ischemia. Decreased oxygen delivery associated with anemia during isovolemic hemodilution results in progressive increases in latency of SSEPs.

Incorrect

[Try again](#)



3. A 39 year old male presents with scoliosis for complex spine surgery. He is morbidly obese, diabetes, hypertensive. The surgery was prolonged with large volume blood loss. He was resuscitated with 7L crystalloid, 6 packed cells, 3 FFP and 1 platelets for a 3.5 litre blood loss. 4 hours into the postop in the ICU, he had hypotension and difficulty with ventilation and oxygenation. CXR shows fluffy infiltrates. The following could be likely diagnosis except

- A. Hemolytic transfusion reaction
- B. Adult respiratory distress syndrome
- C. Transfusion associated acute lung injury
- D. Transfusion associated circulatory overload

Go to Q 4



Correct answer

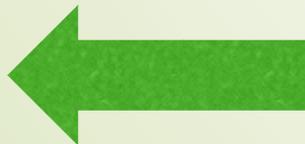


A. Hemolytic transfusion reaction

Hemolytic transfusion reactions are not the likely cause of lung infiltrates as in the above case. They usually manifest as bleeding diathesis, hypotension and hemoglobinuria. The classic signs and symptoms of a hemolytic transfusion reaction which are chills, fever, chest and flank pain, and nausea are masked by anesthesia. Intravascular hemolysis occurs when there is a direct attack on transfused donor cells by recipient antibody and complement. Treatment consists of prevention of kidney failure and a coagulopathy (DIC).

Ch 61; Patient and blood management,
Ronald Miller. Miller's textbook of anesthesia

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B. Adult respiratory distress syndrome

Adult respiratory distress syndrome (ARDS) is a rare but important complication of blood transfusion with a high mortality rate. ARDS is characterised by noncardiogenic pulmonary oedema and is often associated with sepsis. Factors which have been implicated include neutrophil sequestration and complement activation, macrophages, metabolites of the arachidonic acid cascade and cytokines, all of which contribute to the amplification of the inflammatory process. In particular, leuco-agglutinins have been implicated with blood transfusions. Treatment is generally supportive.

Incorrect

[Try again](#)

Transfusion associated acute lung injury (TRALI)

Transfusion-related acute lung injury (TRALI) is a rare transfusion reaction presenting as respiratory distress and lung infiltrates with difficulty in oxygenation and ventilation similar to ARDS. It occurs after transfusion of blood products within 6 hours. It is thought to be a neutrophil mediated injury. Treatment of TRALI is currently limited to supportive care, and so prevention becomes a primary goal. Recently, an intense analysis of the risk factors associated with TRALI have been reported. Risk factors include higher interleukin-8 (IL-8) levels, liver surgery, chronic alcohol abuse, shock, higher peak airway pressures while being mechanically ventilated, smoking, and positive fluid-balance. The decreased use of plasma from female multiparous donors has reduced the incidence of TRALI.

Transfusion-Related Acute Lung Injury (TRALI): Current Clinical and Pathophysiologic Considerations
Kelly Swanson et al.

Incorrect

[Try again](#)

Transfusion associated circulatory overload(TACO)

The clinical and radiologic manifestations of TACO and TRALI are similar. While the pathogenesis of TRALI is an inflammatory permeability edema, TACO is more of hydrostatic non-inflammatory edema. Echocardiography and B-type natriuretic peptides can help with differential diagnosis, however many times it becomes difficult to differentiate and sometimes both may coexist.

Crit Care Med. 2006 May;34(5 Suppl):S109-13. Gajic O^{et al}. Pulmonary edema after transfusion: how to differentiate transfusion-associated circulatory overload from transfusion-related acute lung injury.

Incorrect

[Try again](#)



4. A 54 year old patient is scheduled for 2 level lumbar fusion. She has had chronic back pain and has been on oral morphine, pregabalin and meloxicam. The following could be useful as intraoperative medications for postoperative pain relief except;

- A. Lidocaine infusion
- B. Acetaminophen
- C. Ketamine infusion
- D. Remifentanil infusion
- E. Perioperative anticonvulsants

Go to Q 5



A. Lidocaine infusion

Systemic lidocaine has been shown to improve postoperative pain scores in patients recovering from major spine surgery in a study by Farag et al. A study by Groudine et al showed that intravenous lidocaine speeds the return of bowel function, decreases postoperative pain, and shortens hospital stay in patients undergoing radical retropubic prostatectomy. In contrast, lidocaine has not proven helpful in patients having total hip arthroplasty, gynecological surgery, cardiac surgery, or tonsillectomy.

Effect of Perioperative Intravenous Lidocaine Administration on Pain, Opioid Consumption, and Quality of Life after Complex Spine Surgery. Farag, Ehab et al; Anesthesiology Issue: Volume 119(4), October 2013, p 932–940.

Intravenous lidocaine speeds the return of bowel function, decreases postoperative pain, and shortens hospital stay in patients undergoing radical retropubic prostatectomy..Groudine SB, Fisher HA, Kaufman RP Jr, Patel MK, Wilkins LJ, Mehta SA, Lumb PD. Anesth Analg. 1998;86:235–9.

Incorrect

Try again

B. Acetaminophen

Acetaminophen has recently gained increased attention as a pain control adjunct in spinal surgery patients. Scheduled intravenous acetaminophen was associated with improved pain scores and greater patient satisfaction with pain control than placebo, however, there was no difference in narcotic usage after lumbar laminectomy.

Ref: Cakan et al; J Neurosurg Anesthesiol 2008;20:169–73.

Incorrect

[Try again](#)

C. Ketamine infusion

Ketamine antagonizes N-methyl D-aspartate receptors. It also causes modulation of opiate receptors. Studies have shown that preventative ketamine use in opiate-dependent patients with chronic pain as well as opioid naïve patients reduces total opioid consumption in the postoperative period

Anesthesiology. 2010 Sep;113(3):639-46. Loftus RW ^{et al}
Intraoperative ketamine reduces perioperative opiate consumption in opiate-dependent patients with chronic back pain undergoing back surgery.

Incorrect

[Try again](#)

Correct answer

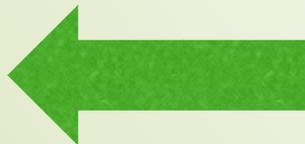


D. Remifentanil infusion

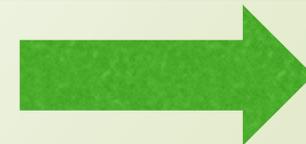
Remifentanil is often used during spine surgery when neuromonitoring is employed. It is an ultra short acting opioid and the effect is evanescent. It has been quoted to produce some degree of hyperalgesia and may modulate opioid induced hyperalgesia. Hence this drug would not be useful to provide analgesia for the postoperative period.

Expert Opin Drug Saf. 2014 May; 13(5):587-603. An evidence based systematic review of remifentanil associated opioid-induced hyperalgesia. Rivosecchi RM et al

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E. Perioperative anticonvulsants

Gabapentin and pregabalin are anti-convulsants typically used for the treatment of chronic neuropathic pain. They work by binding the $\alpha_2\text{-d}$ subunit of N-type voltage-gated calcium channels, thereby inhibiting the release of neurotransmitters and reducing neuronal excitability. In a systematic review and meta-analysis of randomized controlled trials, Yu et al. found that both gabapentin and pregabalin were efficacious in reducing postoperative pain and narcotic requirements after lumbar spinal surgery.

Spine (Phila Pa 1976) 2013;38:1947–52. Gabapentin and pregabalin in the management of postoperative pain after lumbar spinal surgery: a systematic review and meta-analysis. Yu L, Ran B, Li M, et al.

Incorrect

[Try again](#)



5. A 58 year old man was involved in a motor vehicle accident and was brought by paramedics in a cervical collar. On initial examination, he appears drowsy. He does not move all four extremities. His blood pressure is 84/50 and heart rate is 47. What is the reason for his shock?

- A. Vasodilation
- B. Cardiac failure
- C. Epinephrine release
- D. Blood loss

Back to Q 1



Correct answer

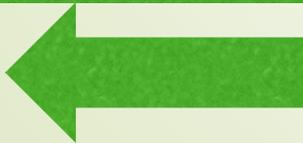


A. Vasodilation

Patients with SCI above the T4 level are at high risk of the development of neurogenic shock. The patient suffers a sympathectomy, resulting in unopposed vagal tone. This leads to a distributive shock with hypotension and bradycardia. The loss of sympathetic tone results in vasodilation and inability to redirect blood flow from the periphery to the core circulation. Bradycardia is a characteristic finding of neurogenic shock and may help to differentiate from other forms of shock. Treatment requires fluid resuscitation as the first step (often referred to as “filling the tank”) followed by pressors and inotropes.

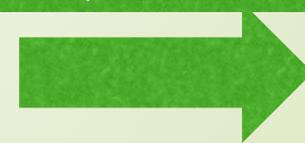
Emergency Neurological Life Support: Traumatic Spine Injury. Deborah M. Stein et al; J of neurocrit care; 2012; Sep;17 Suppl 1:S102-11.
Early Acute Management in Adults with Spinal Cord Injury Clinical Practice Guidelines: www.pva.org (2008). Accessed. May 2012.

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End of set

Back to Question 1



B. Cardiac failure

Cardiac failure is not the right answer. There is no fluid overload and the myocardial contractility is not altered.

Incorrect

[Try again](#)

C. Epinephrine release

Epinephrine release causes tachycardia and hypertension is not the cause of the shock seen after spine injury

Incorrect

[Try again](#)

D. Blood loss

Blood loss usually presents as tachycardia and hypotension while patients with neurogenic injury present with bradycardia and vasodilatory hypotension. In the patient with multiple injuries, other causes of hypotension, such as hemorrhagic shock, can be present. These causes must be identified and immediately addressed. Care should be taken not to assume that a patient has neurogenic shock because of a lack of tachycardia, as young, healthy patients, elderly patients, and patients on pre-injury beta-blockers will often not manifest tachycardia in the setting of hemorrhage.

Incorrect

[Try again](#)